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Special Handling

BYE-66695-66

c# 24

TRACKING, TELEMETRY, COMMANDS, POWER

AND

PYROTECHNIC INTERFACE SPECIFICATION

FOR

ADVANCED PROJECTS PAYLOAD

AND

PIPERAM 241 AGENA ORBITAL VEHICLE

Prepared by: _____

Advanced Projects Manager

~~_____~~
PIPERAM 241 Manager

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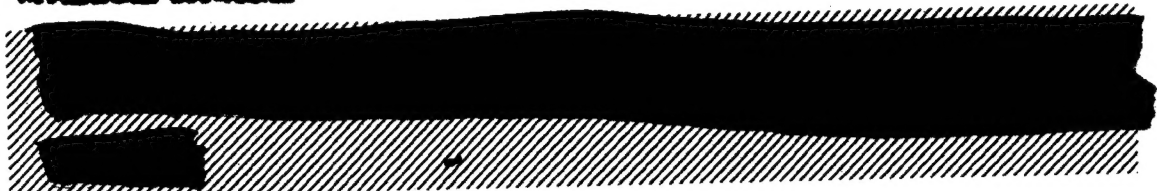
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1.0 SCOPE

1.1 This document shall define the electrical interface requirements of advanced Projects Payload Systems and the Program 241 Agena Orbital Vehicles. Specifically, the areas affecting tracking, telemetry, commands, power, and pyrotechnics are discussed. The requirements defined in this specification will allow both the Advanced Projects Payload System, J-1, as described in Requirements Specification T3-4-001, and J-3 as described in Requirements Specification T3-5-016 to be electrically compatible with Program 241 Agena Orbital Vehicles 1641 and up as described in DMSO detail Specification, Program 241 Satellite System.

2.0 APPLICABLE DOCUMENTS



REFERENCES:

DMSO 4479698 - Specification for Electromagnetic Interference Control Requirements and Electrical Interface for Agena System.

REQUIREMENTS:

134217 - Interface-Payload/Vehicle (Mechanical)

3.0 REQUIREMENTS:

3.1 Electrical Interface Connectors

The Payload Systems (hereafter known as the Payload)/Program 241 Agena Orbital Vehicle (hereafter known as the Vehicle) electrical interface shall consist of six (6) connectors. The payload connectors shall be physically located per DMSO 134217 Interface, Payload/Vehicle (Mechanical) interface drawing. The vehicle shall provide compatible mating connectors wired to the appropriate functional cables. The payload connectors and functions are

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3.2 Connector **66-C3022**

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3.2.1 Pyro Power Connector AJ-20X (PUSH-1-112-(01))

Vehicle Function	J-1 Function	J-3 Function
A Continuity Loop	None	Pre-launch c/o
B Pyro Shield Tie	None	Same as vehicle
C Pyro Bus Return	None	Same as vehicle
D +24 VDC Pyro Bus	None	Same as vehicle
E Pyro Shield Tie	None	Same as vehicle
F Pyro Bus Return	None	Same as vehicle
G Continuity Loop	None	Same as vehicle
H Pyro Shield	None	Same as vehicle
J Pyro Bus Return	None	Same as vehicle
K +24 VDC Pyro Bus	None	Same as vehicle
L +24 VDC Pyro Bus	None	Same as vehicle

Note: Pins G and A shall be jumpered on vehicle side.

Pins C and D are a twisted shielded pair with pin B as the shield tie.

Pins F and L are twisted shielded pair with pin E as the shield tie.

Pins J and K are a twisted shielded pair with pin H as the shield tie.

The J-1 Payload System does not have an AJ-20X interface connector. The J-1 payload system receives pyro power through the pyro signal connector AJ-21X.

Reference paragraph 3.2.2.

3.2.2 Pyro Signal Connector AJ-21X (PUSH-22-21 PW (C1))

Vehicle Function	J-1 Function	J-3 Function
A Pyro Bus Return	Same as Vehicle	Spare
B Pyro Bus Return	Same as Vehicle	Spare
C Pyro Shield Tie	Same as Vehicle	Spare

etc.

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Vehicle ⁶⁶⁻⁰³⁰²² Function

	J-1 Function	J-3 Function
D Transfer to Ext. No. 2	Switch Recovery	Spare
	sequence signals	
E Transfer to Ext. No. 2	from "A" SW circuits	Spare
	to "B" SW circuits	
F Arm signal	A & B SW? Arm. funct.	Same as J-1
G Arm signal	A & B SW? Arm. funct.	Same as J-1
H AP Orbit Mode Signal	Pyroload to Orbit	Same as J-1
J AP Orbit Mode Signal	As above	Same as J-1
K Separation Signal	A & B SW Pyroload Sep.	Same as J-1
L Separation Signal	A & B SW Pyroload Sep.	Same as J-1
M Continuity Loop	Prel. uncl. c/o	Same as J-1
N Disconnect Signal	None - Spare	A & B SW Conn. Disconnect
O +64 VEC Pyro Bus	Same as vehicle	Spare
P +64 VEC Pyro Bus	Same as vehicle	Spare
Q In-Flight Reset	Door Eject	Same as J-1
R In-Flight Reset	Door Eject	Same as J-1
S Transfer Signal	A & B SW Transfer Function	Same as J-1
T Transfer Signal	A & B SW Transfer Function	Same as J-1
	Spare	A & B SW Conn. Disconnect



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Primary Power Connector
AJ- (PROTECTOR - 1P (Oil))

Pin No.	Function	J-1 Function	J-3 Function
A	7V Unreg.	Primary Power	Same as J-1
B	7V Unreg.	Primary Power	Same as J-1
C	4 VDC Unreg.	Primary Power	Same as J-1
D	7V Unreg.	Primary Power	Same as J-1
E	3 VDC Reg.	Primary Power	Spare
F	3 VDC Reg.	Primary Power	Spare
G	3 VDC Reg.	Primary Power	Spare
H	3 VDC Reg.	Primary Power	Spare
I	AC Shield Tie	Primary Power	Same as J-1
K	115V 400 Hz (B) Ret.	Primary Power Ret.	Same as J-1
L	115V 400 Hz (A)	Primary Power Ret.	Same as J-1
M	115V 400 Hz (C)	Primary Power	Same as J-1
N	Unreg. Return	Primary Power Ret.	Same as J-1
P	Unreg. Return	Primary Power Ret.	Same as J-1
R	Unreg. Return	Primary Power	Same as J-1
S	Unreg. Return	Primary Power	Same as J-1
T	Reg. Ret.	Primary Power Ret.	Spare
U	Reg. Ret.	Primary Power Ret.	Spare
V	Reg. Ret.	Primary Power	Same as J-1
W	Reg. Ret.	Primary Power	Same as J-1
X	Reg. Ret.	Primary Power	Same as J-1
Y	Reg. Ret.	Primary Power	Same as J-1
Z	Reg. Ret.	Primary Power	Same as J-1

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3.2.3 Primary Power Connectors (Continued)

Notes: Pins A and B are a twisted pair.
Pins B and P are a twisted pair.
Pins C and R are a twisted pair.
Pins D and S are a twisted pair.
Pins K, L, and M are a twisted shielded triad with pin J as the shield tie.
Pins V, W, and X are a twisted shielded triad with pin J as the shield tie.
Pins E and F and T are a twisted triad.
Pins G and H and U are a twisted triad.

3.2.4 Command Connector (AJ-23V (PT07SE-22-55P (011)))

<u>Vehicle Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
A VHF Chmd 101	Spare	CR No. 1 Exposure Control Override
B VHF Chmd 102	Spare	CR No. 2 Exposure Control Override
C VHF Chmd 103	Spare	CR No. 1 Filter Control
D VHF Chmd 104	Spare	CR No. 2 Filter Control
E KIM-Servo 38	Same as J-1	Early A to B Transfer
F KIM-Servo 39	Spare	DISIC Early A to B Transfer
G KIM-Servo Mastle	Spare	AP TIM Coms takeovers On for Tape Recording
H KIM-Servo Mastle	Spare	SRV Battery Monitor CR
I KIM-Servo Mastle	Spare	Exposure Control Relay
J KIM-Servo Mastle	Full Lights On	Exposure Control
K KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	DISIC Mastle Switch
L KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
M KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
N KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
O KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
P KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
Q KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
R KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
S KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
T KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
U KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
V KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
W KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
X KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
Y KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle
Z KIM-Servo Mastle	SRV Bldg. Mastle/ Mastle	SRV Bldg. Mastle/ Mastle

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<u>Vehicle Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
P STC 52	Spare	Exposure Control
R V/R Shield Return	Same as vehicle	Same as vehicle
S AP to Tape Recorder Track 1	TL Data	Same as J-1
T VHF Cmd 110	Spare	Emergency Ops. Select/ Mode By-Pass
U AP to Tape Recorder Track 2	TL Data	Same as J-1
V Spare	Spare	Spare
W AHA 6/VHF Cmd 106	V/H Ramp Select	CR Prog. Select
X AP Unb. Cmd No. 3 (J100-40)	Stereo Operate	Same as J-1
Y AP Unb. Cmd No. 1 (J100-40)	Spare	Continuity Loop Power
Z SFC 17	(a) Clock Interrogate (b) Switch Chnn. 18 to clock from IR roller non.	CR Dynamic TIM Enable
a SFC 27	V/H Programmer Start	Same as J-1
b SFC 28	Redundant OFF & FO Lights OFF all programs.	Redundant OFF, all programs
c SFC 29	Commutator & TIM Per. ON	Intermin. advantage
d SFC 30	Program 1 - ON	Same as J-1
e SFC 31	Program 1 - OFF	Same as J-1

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Vehicle P.	J-1 Function	J-2 Function
t SFC 44	Program 4 - ON	Same as J-1
u SFC 45	Program 5 - OFF	Same as J-1
v SFC 46	Program 6 - ON	Same as J-1
w SFC 47	Program 7 - OFF	Same as J-1
x SFC 48	Intermix Cntrl.	DI:IC ON
y SFC 49	Cont. TLM Channels Disable	DI:IC OFF
z SFC 50	Commutator 2: TLM Pwr. OFF	Exposure Control
AA SFC 14	(a) V/H Delay Homing Cmd. (b) Yaw Prog. Start	(a) V/H delay reset (b) V/H oblateness start (c) Exposure control reset (d) Yaw Programmer start
BB SFC 24, Cmd No. 2	Arm By-pass No. 2	Same as J-1
CC SFC 25/VHF Cmd 106	V/H Ramp Amp. Select	OP Select No. 1
DD SFC 26/VHF Cmd 107	Program Select	OP Select No. 2
EE SFC 27/VHF Cmd 110	V/H Ramp Start Select	CR Mode Select
FF SFC 28/VHF Cmd 111	OP. Mode Select	V/H Start level select
GG SFC 29/VHF Cmd 112	Intermix 1 Select	V/H half-cycle level
HH SFC 30/VHF Cmd 113	Intermix 2 Select	V/H delay Select

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3.2.4 Command Connector (Continued)

NOTE: SPC = Stored Program Command

ANA - S-Band Analog Command

VHF CMD - VHF Digital Receiver Command

3.2.5 Telemetry Receiver

AJ-24 (PK7 P- 012)

<u>Vehicle Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
A Spare	Spare	Spare
B Link 1	Redundant TM	Spare
C Spare	Spare	Spare
D AP 4	Link 2, Conn.	Spare
E AP 237	Redundant TM	Spare
F AP 238	Redundant TM	Spare
G AP 239	Redundant TM	Spare
H AP 240	Redundant TM	Spare
J AP Umb. Mon. 6	Red Temp Mon	Same as J-1
K AP 241	Redundant TM	Spare
L AP 242	Redundant TM	Spare
M AP 243	Redundant TM	Spare
N AP 244	Redundant TM	Spare
P AP 231	Redundant TM	Spare
R AP 232	Redundant TM	Spare
S AP 233	Redundant TM	Spare
T AP 234	Redundant TM	Spare
U AP 235	Redundant TM	Spare
V AP 236	Redundant TM	Spare
W Link 2 TM ON Sig.	20 VDC TM Pwr. ON	TM Commutators ON and Cent. Clock Reset

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<u>Link I Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
X Link I: 120 W Sig.	Communicator ON	ILN Communicators ON and Cont. Clock Readout
Y Urb. TUN Signal Ant.	Same as Vehicle	Same as J-1
Z AP Unit, Mon. 1	Continuously Loop ILN ON Mon.	Spare
a AP 15-2	Spare	Link I, Chan. 15
b AP 16-	Spare	Link I, Chan. 16
c AP 146	Spare	Spare
d A 218	Spare	Spare
e AP 7	Link I, Chan. 7	Same as J-1
f Thrust Mon. No. 1	Spare	Same as Vehicle
g AP 9	Link I, Chan. 9	Same as J-1
h Thrust Mon. No. 2	Spare	Same as Vehicle
i AP 10	Link I, Chan. 10	Same as J-1
j Thrust Mon. No. 3	Spare	Same as Vehicle
k AP 6	Link I, Chan. 6	Same as J-1
l Spare	Spare	Spare
m AP 13	Link I, Chan. 13	Same as J-1
n AP 13	Link I, Chan. 13	Same as J-1
o AP 11	Link I, Chan. 11	Same as J-1
p AP 8	Link I, Chan. 8	Same as J-1
q AP 18	Link I, Chan. 18	Same as J-1
r Thrust Mon. No. 4	Spare	Same as Vehicle
s TUN Sig. Ant.	Same as Vehicle	Same as Vehicle
t TUN Sig. Ant.	Same as Vehicle	Same as Vehicle
u Stateline	-	

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<u>Vehicle Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
70 Shield Tie	Same as Vehicle	Same as Vehicle
72 Shield Tie	Same as Vehicle	Same as Vehicle
AP Umb. Test. No. 1	Arm Bypass Int.	Same as J-1
AP Relay Inset	Same as Vehicle	Same as Vehicle
AP AP Relay Inset	Same as Vehicle	Same as Vehicle
AP Thrust Mon. No. 3	Spare	Same as Vehicle
AP Thrust Mon. No. 4	Spare	Same as Vehicle
AP Umb. Mon. No. 4	Spare	Continuity Loop
AP Relative Humidity Mon.	Same as Vehicle	Same as J-Vehicle
AP Relative Humidity Ret.	Same as Vehicle	Same as Vehicle
AP Umb. Mon. No. 5	+28V Pad c/o Mon.	AP Orbit Mode Mon.
AP AP Cmd. No. 5	+28V Pad c/o	AP Orbit Mode Control

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3.2.6 Test Connector (Flight Functions) J-1 (PTR-55FOW)

<u>Vehicle Function</u>	<u>J-1 Function</u>	<u>J-3 Function</u>
A Roll Program Input	Low Programmer Voltage Output	Same as J-1
B Roll Program Int.	Low Programmer Return	Same as J-1
C Shield Tie	Low Programmer Shield Tie	Same as J-1
D Shield Tie	Flight Spares	Same as J-1

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Electrical Interface Requirements

3.3.1 Electrical Power

The vehicle shall supply regulated DC and unregulated DC for primary power, unregulated DC for pyrotechnic power and 115 V 400 Hz single phase power to the payload. Power shall be supplied continuously during a normal mission. It includes pre-flight and mission times except that pyrotechnic power will be removed from the payload interface when the vehicle internal external power switch is in the external position. The payload and all of its subsystems including GSE systems shall be capable of operating without impairment of function when supplied from the main bus of a control system with power within the limits and characteristics specified in the following subsections and under the conditions of power utilization prescribed by Section 3.3.1.

3.3.1.1 Power Supply Characteristics

3.3.1.1.1 Steady State Voltages

The steady state voltages of the central power supplies measured at distribution buses in the vehicle shall be within the limits specified below at zero load.

- Primary unregulated DC +22.0 to +29.5 volts.
- Pyrotechnic unregulated DC +22.0 to +29.5 volts.
- Regulated Positive DC 27.75 to 28.87 volts
- Regulated Negative DC 27.75 to 28.87 volts
- AC Bus, 115.799 to 117.3 VAC rms

The voltage drop across the vehicle distribution buses for the primary power shall be 0.5 volt DC and 1.0



the total non-fundamental frequency content of the voltage wave form of the vehicle AC supply measured as distortion of the fundamental shall not exceed 5% for noise-free linear loads from zero to rated load for frequencies above the fundamental supply frequency.

3.3.1.1.2 Amplitude Modulations

The amplitude modulation of the AC supply shall not exceed 7 volts p-to-p over a period of not less than 1 second for noise-free linear loads for frequencies below the fundamental supply frequency. These limits shall not be exceeded for DC input voltages as specified in 3.3.1.1.1.

3.3.1.1.2.3 Voltage Transients

The dynamic regulation of the vehicle AC supply shall be such that, under the worst combination of step function changes in all input voltages within prescribed limits and in load current from no load to rated load or vice-versa, the peak output voltage shall remain within +100 volts and -50 volts of 112.6 volts and shall return to 112.6 $\pm$ 15 within 100 milliseconds.

3.3.1.1.2.4 Frequency

The frequency of the vehicle AC supply shall be maintained between

399.972 and 400.008 Hz. These limits shall apply for steady state conditions and under worst combinations of step function changes in input voltages within prescribed limits and in load current from no load to rated load or vice versa.

3.3.1.1.3 Pyrotechnic Power Supply Characteristics

The pyrotechnic power supply shall be capable of supplying 60 amp for 5 milliseconds while maintaining a bus voltage of 14 to 28.5 volts at the pyrotechnic junction or connection. No pyrotechnic power requirements exist during start, recovery sequences, or upon receipt by the payload of other secure commands.

3.3.1.1.4 Regulated Supply Characteristics

3.3.1.1.4.1 Output Impedance

The output impedance of the Regulated DC supply shall not exceed 0.1 ohm open circuit and 0.4 ohm with a 4 Ω to 200K Ω load.

3.3.1.1.4.2 Transient Response

The dynamic regulation of the vehicle regulated supply shall be such that, under the worst combination of step function changes in all input voltages within prescribed limits and in load current from no load to rated load or vice-versa the output voltage shall remain within ± 5 volts of ± 28.5 volts and comply with a time constant (63% response) of 100 μ sec.

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3.1.2 Load Characteristics

3.1.2.1 J-1 Primary Power Consumption

The current requirements of the J-1 payload system shall not exceed the limits listed below for the mode 1 (all systems in operation) and mode 2 (all systems quiescent) conditions.

Unregulated Current:

- A. Mode 1 (not to exceed 5 hrs. with a duty cycle of 20 min. ON 70 min. OFF.)
1. Average - 12 amps
 2. Peaks - 25 amps max. not to exceed 200 milliseconds.
- B. Mode 2 (continuous during mission)
1. Average - 1.5 amps
 2. Peaks - None

Plus Regulated DC Current

- A. Mode 1 (not to exceed 5 hrs. with a duty cycle of 20 min ON 70 min OFF.)
1. Average - 5 amps
 2. Peaks - 10 amps max. not to exceed 200 milliseconds.
- B. Mode 2 (continuous during mission)
1. Average - 6.6 amps
 2. Peaks - None

Minus Regulated DC Current:

- A. Mode 1 (not to exceed 5 hrs. with a duty cycle of 20 min ON 70 min. OFF.)
1. Average - 0.05 amps
 2. Peaks - None
- B. Mode 2 (continuous during mission)
1. Average - 0.05 amps
 2. Peaks - None

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Mode 1 and Mode 2 - 150 milliamps average

All continuous power requirements shall be maintained and subject to design review by Program 241 CSE

3.2.1.2.2 J-3 Primary Power Consumption

The current requirements of the J-3 Payload system shall not exceed the limits listed below for Mode 1 (all systems in operation) Mode 2 (all systems quiescent) and Mode 3 (secondary system in operation).

Unregulated Current:

- A. Mode 1 (not to exceed 15 hrs. with a duty cycle of 10 min ON, 70 min. OFF.)
 - 1. Average - 30 amps
 - 2. Peaks - 60 amps not to exceed 100 milliseconds.
- B. Mode 2 (continuous during mission)
 - 1. Average - 3 amps
 - 2. Peaks - none
- C. Mode 3 (not to exceed 15 hours with a duty cycle of 45 min ON, 45 min OFF.)
 - 1. Average - 8 amps
 - 2. Peaks - 12 amps not to exceed 200 milliseconds.

AC Current

- A. Mode 1 (not to exceed 5 hrs. with a duty cycle of 20 min ON, 70 min. OFF.)

Mode 1

- 1. Average - 0.6 amps
- 2. Peaks - 0.85 amps not to exceed 500 milliseconds

- B. Mode 2 (continuous during mission)

Mode 2

- 1. Average - 0.1 amps
- 2. Peaks - none

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Mode 3 (not to exceed 15 hrs.)

None required for secondary system.

All continuous power requirements shall be minimized and subject to design review by Program Phil CHE.

3.3.1.2.1 Load Impedance

- a. The impedances presented by each payload subsystem to the vehicle DC power supply shall be essentially linear and noise-free to the greatest extent possible.
- b. The loads presented to the vehicle AC supply by each payload subsystem shall have a power factor as near unity as practicable for all modes. Loads shall not be presented with steady state power factors less than 0.80 lagging and 0.95 leading, nor with unsymmetrical half wave loading.

3.3.1.3 Switched Capacitor Loads

Switched capacitor loads shall have surge current limiting resistors in series.

3.3.1.4 Inductive Spike Suppression

The use of diodes (or other equally effective devices) to suppress spikes that result from collapsing magnetic fields is mandatory in every case where a current that flows through an inductance is interrupted. The diode (or other suppression device) shall be mounted as close to the inductance as possible.

3.3.1.5 Cables and Connectors

Cables and connectors for the payload system shall be fabricated conforming to the applicable requirements of paragraphs 3.3.11.1, 3.3.11.2, 3.3.11.3, and paragraphs 3.3.6.1.4 - 3.3.6.1.7 of this document to every extent possible.

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3.3.1.6 AF Signal Circuits

AF signal circuits (0-150 KC) which require shielding for proper operation shall be shielded with the shield grounded at the vehicle ground point only. Shields shall not be connected in any way which creates a loop having a natural resonance frequency. The shield shall be connected through the pins provided for various interference suppressors (see paragraph 3.2).

3.3.1.7 Grounding

Neither the payload nor any of its subsystems shall ground any power or signal returns to chassis or structure. All airborne ground return leads shall be grounded to the vehicle frame through the vehicle ground point. (See DSC 4479698, Paragraph 3.2.8.1). However R.F. by-pass devices may be utilized to control EMI.

3.3.1.8 Bonding

The payload and its subsystems shall conform to applicable portions of bonding requirements of paragraph 3.2.12.1 - 3.2.12.2.2 and paragraphs 3.2.12.3 - 3.2.12.5 of DSC 4479698 to every extent possible.

3.4 Operational Interface Command and Function Descriptions

3.4.1 Operational Commands

3.4.1.1 AF Commands (AF-GIX Pins A, B, C, D, J, K, N, T)

a. General Description. Encoded, real time commands may be transmitted during vehicle acquisition and shall be disabled at all other times. Minimum time between the trailing edge and leading edge of consecutive commands shall be 1 second.

c. Electrical Requirements

1. Duration 250 $\pm$ 100 ns.
2. Source Current Capacity - 2 A maximum
3. Command Voltage - ± 24 V regulated referenced to unregulated return.
4. The command lines shall present an open circuit to the payload in the absence of a command.

3.4.1.2 Analog S-band commands (AJ2X - Pins L, W, CC, ED, EH, FF, GG, HH)

- a. Signal Description - The unsecure real time commands may be initiated during vehicle acquisition and shall be disabled at all other times. Minimum time between trailing and leading edge of consecutive commands shall be 1 second.

b. Electrical Requirements

1. Pulse Duration - 1 second maximum
2. Source Current Capacity - 2 amps maximum
3. Command Voltage - 24 VDC unregulated referenced to unreg. return.
4. The command lines shall present an open circuit to the payload in the absence of a command.

NOTE: All S-band commands are backed up by VHF commands.

Payload circuits requiring S-band commands shall be capable of satisfactory operation when commanded from either source. See Para. 3.4.1.1 Sec. 3.

3.4.1.3 S-band Secure Commands (TIN-0000 38 and 39 (AJ2X - Pins E,F))

- a. Signal Description - Secure, real time commands may be initiated during vehicle acquisition and shall be disabled

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at all other times including ascent. The command source will generate only one command output per acquisition. Disable circuits, to protect payload against repeated commands, if required, shall be in the payload system.

1. Electrical Requirements

1. Duration - 1 second minimum but may be as long as 15 minutes.
2. Source Current - capacity 2 amps maximum.
3. Command Voltage - 48 VDC is req. referenced to common return.

3.4.1.4 Stored Program Commands (AJ23: Pins K, P, L, a - z, AA)

- a. Signal Description - The stored Program Command source shall be the vehicle orbital programmer. The commands are stored in the form of square holes in 35 mm tape. The tape speed and position shall be kept synchronised with the orbital period so commands shall occur at the desired time. The commands shall take the form of a minimum ground pulse.

1. Electrical Requirements

Duration - 1.5 $\pm$ 0.5 seconds.

Source Current Capacity - 100 ma per channel, with a total of 200 ma.

3.4.2 Recovery Signals

The recovery signals shall be considered by the payload systems as a sequence of signals that are time related. The signals shall be generated in order: Arm, Transfer, Disconnect, Separate and Transfer to Experiment No. 2. The Arm, Transfer, Disconnect and Separate Signals shall be terminated simultaneously, and their signal lines will be shorted together after removal of power and prior to Recovery Timer Reset.

A recovery signal sequence is required for each of the two Satellite Recovery Vehicles, known as the A and B SRV's, that form a part of the J-1 and J-3 payload systems. The recovery timer accuracy between events shall be 0.5 seconds or 0.11 percent, whichever is greater.

NOTE: For differences in recovery signal requirements of the J-1 and J-3 payload systems reference paragraphs 3.4.2.2, 3.4.2.3 and 3.4.2.5. SRV recovery may be effected without an AF Recovery Enable Signal but this does not negate the requirement for the AF Recovery Enable Signal.

3.4.2.1 Arm Signal (AF-41x pins 7 & 0)

a. Description. The Arm signal shall be the first signal of the recovery sequence. This signal is the first signal to be received by the SRV and is the first signal to be received by the SRV. This signal is the first signal to be received by the SRV and is the first signal to be received by the SRV.

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B. Electrical Description

1. Time of Initiation - T-76 seconds
2. Duration - 104 seconds
3. Source Current Capacity - 2 amps max.
4. Signal Voltage - 24 VDC unregulated referenced to unregulated return.

3.4.2.2 Transfer Signal (AJ-11X pins U & V)

a. Signal Description - The transfer signal shall be the second signal of the recovery sequence. Upon receipt of the transfer signal the J-1 and J-3 payloads and all JF shall activate those functions required at this time to prepare for the ejection of that JF.

b. Electrical Description

1. Time of Initiation - T-1 second
2. Duration - 27 seconds
3. Source Current Capacity - 2 amps max.
4. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

3.4.2.3 Disconnect Signal (AJ-21X pins W & V)

a. Signal Description - The Disconnect signal shall be the third signal of the recovery sequence. Upon receipt of the Disconnect signal the J-3 payloads shall cause the FSD to disconnect the payload and on JFV to be disconnected. The Disconnect signal shall also cause the JF interface connected by the JFV to be disconnected at the time of the Disconnect signal.

Electrical Description

1. Time of Initiation - T-0 seconds
2. Duration - 26 seconds
3. Source Current Capacity - 2 amps max.
4. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

2.4 Separation Signal (AJ-21X pins K & L)

a. Signal Description. The Separate signal shall be the fourth signal of the recovery sequence. Upon receipt of the separate signal the J-1 and J-3 payload systems shall cause the physical separation of the payload and an ESW.

b. Electrical Description

1. Time of Initiation - T + 1 second
2. Duration - 27 seconds
3. Source Current Capacity - 2 amps max.
4. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

2.5 Transfer to Experiment No. 2 (AJ-21X pins 9 & 10)

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b. Electrical Description

1. Time of Initiation - $\pm 3\%$ seconds
2. Duration - 34 seconds
3. Source Current Capacity - 2 amps max.
4. Signal Voltage - 24 VDC unregulated referenced to unregulated return.

34.3 Special Airplane Commands

34.3.1 In-flight Reset (AJ-21X Pins S & I)

a. Signal Description - The In-flight reset signal shall be initiated by the physical separation of the vehicle and its booster adapter, nominally 2.5 seconds after the separation command (160 seconds after lift off). Exact time is mission peculiar.

b. Electrical Description

1. Duration - 1 second minimum required. Signal may be continuous for duration of mission.
2. Source Current Capacity - 2 amps max.
3. Signal Voltage - 24 VDC unregulated referenced to unregulated return.

NOTE: To conserve vehicle power the payload shall remove all loads from the In-flight reset command as soon as practicable, after receipt of the command.

34.3.2 AP Orbit Mode Signal (AJ-21X Pins H & J)

a. Signal Description - The AP Orbit Mode Signal shall be initiated by the vehicle to indicate the end of powered flight, nominally 450 seconds after lift-off. Exact time is mission

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regular. Upon receipt of the signal the payload shall be placed in a mission ready condition.

b. Electrical Description

1. Duration - 5 seconds $\pm$ 1 second
2. Source Current Capacity - 2 amps max.
3. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

3.4.3.3 AP Data Enable (AJ-23X Pin O)

a. Signal Description - The AP Data Enable signal shall be initiated by the vehicle each time payload functions are to be tape recorded. The exact times shall be coordinated on a per mission basis.

b. Electrical Description

1. Duration - Continuous during the tape recording of desired data - 10% of an Orbit period maximum.
2. Source Current Capacity - 1 amp max.
3. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

3.4.3.4 AP Recovery Enable (AJ-23X Pin H)

a. Signal Description - The AP Recovery Enable Signal shall be initiated by the vehicle at the time of enabling a Primary recovery sequence or at the time of executing a Lifebest UI or UI recovery sequence.

b. Electrical Description

1. Duration - 1 sec. min required. Command may be continuous from initiation to Recovery timer event No. 18 (3 hrs.)

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2. Source Current Capacity - 2 amp max.

3. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

3.4.3. Link I TLM CW signal (AJ-24X Pins V & M)

a. Signal Description - The Link I TLM CW signal shall be initiated by the vehicle and shall be maintained while the TLM system is operating. The signal shall be generated during each acquisition.

b. Electrical Description

1. Duration - continuous during each acquisition (15 minutes average)

2. Source Current capacity - 1 amp max.

3. Signal Voltage - +24 VDC unregulated referenced to unregulated return.

3.4.4 Telemetry Data

The vehicle shall provide TLM channels as required for in-flight monitoring of the payload system.

3.4.4.1 Primary Telemetry Data (AJ-24X Pins a, b, c, g, i, k, n, p, q, r and s).

Payload generated TLM data shall conform to the following requirements. Channel 13, Link I shall be required for Ascent & Orbit monitoring - all other channels shall be required for Orbit Monitoring only.

a. Electrical Requirements

1. Signal Voltage Range - 0 to 5 VDC referenced to TLM signal return.

2. Payload Circuit Impedance - 10 kilo-ohms max. measured

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from a data line to "L" signal return.

3. "L" input impedance - 1 megohm $\pm$ 10%.

3.4.4.2 A218 (Payload SRV Separation Monitors)

a. Monitor Description - The payload shall provide a TM monitor to the vehicle that will indicate payload-SRV physical separation. The monitor shall provide three discrete voltage levels referenced to TM signal return.

b. Electrical Description

1. 0.3 volts both SRV's on board.
2. 1.3 volts "A" SRV ejected.
3. 4.7 volts "B" SRV ejected.

3.4.4.3 Thrust Monitors (AJ-24X- f, h, j, t, BE, CC

a. Monitor Description - The vehicle shall provide a monitor from each thrust valve. The monitor shall indicate thrust valve activation.

b. Electrical Description

1. Pulse duration - 15 milliseconds each.
2. Pulse Repetition Rate - Determined by external torque on vehicle (1 to 10 pps avg.)
3. Pulse Configuration - 48V VDC unreg. continuous - zero VDC during pulse.
4. Source Impedance - 10 kilo-ohms minimum in series with voltage source.
5. Payload Impedance - 20 kilo-ohms minimum, referenced to TM signal return

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3.4.4.4 AP to Tape Recorder Track 1 (AJ-23X Pin S)

The vehicle shall provide on orbit tape recording capability for the payload system. Tape recorder Track 1 shall be available to the payload a minimum of 10 percent of each orbit and during each recovery sequence commencing with the Arm Signal and terminating after the Separation Signal. The payload data to be recorded shall have a maximum pulse repetition rate of 24 pps and shall meet the electrical requirements of paragraph 3.4.4.1, a 1 and 2. The payload data on AJ-23X Pin S shall be monitored in real time during vehicle powered flight.

3.4.4.5 AP to Tape Recorder Track 2 (AJ-23X Pin U)

The vehicle shall provide on orbit tape recording capability for the payload system. Tape recorder Track 2 shall be available to the payload during each recovery sequence commencing with the Arm Signal and terminating after the Separation Signal. The payload data to be recorded shall have a maximum pulse repetition rate of 24 pps and shall meet the electrical requirements of paragraph 3.4.4.1, a 1 and 2. The payload data on AJ-23X Pin U shall be monitored in real time during vehicle powered flight.

3.4.5 Support Electrical Requirements

The vehicle shall provide electrical lines for control and

power to the payload during pre-launch and coast-down

phases of flight.

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power to the payload during pre-launch and coast-down

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3.4.5.1 Unilical Commands

3.4.5.1.1 Unilical Command No. 1 (AJ-23X Pin Y)

Electrical Requirements

1. Command Duration - 5 sec or less
2. Command Source - Momentary Switch
3. Command Voltage - +24 VDC unregulated referenced to vehicle unregulated return.
4. Command Current - 2 amps max.

3.4.5.1.2 AP Unilical Command No. 2 (AJ-23X Pin BB)

Electrical Requirements

Reference paragraph 3.4.5.1.1

3.4.5.1.3 AP Unilical Command No. 3 (AJ-23X Pin X)

Electrical Requirements

1. Command Duration - continuous for required duration not to exceed 5 minutes.
2. Command Source - ON/OFF switch
3. Command Voltage - +24 VDC unregulated referenced to vehicle unregulated return.
4. Command Current - 2 amps max.

3.4.5.1.4 AP Unilical Command No. 4 (AJ-23X Pin Y)

Electrical Requirements

Reference paragraph 3.4.5.1.1

3.4.5.1.5 AP Unilical Command No. 5 (AJ-23X Pin BB)

Electrical Requirements

Reference paragraph 3.4.5.1.1

Reference paragraph 3.4.5.1.1

Reference paragraph 3.4.5.1.1

Reference paragraph 3.4.5.1.1

Reference paragraph 3.4.5.1.1

3.4.5.1.6 AP Relay Reset Command (AJ 205 Plus 1 & AA)

Electrical Requirements

1. Command Duration 5 secs. or less
2. Command Source Emergency switch
3. Command Voltage 44 VDC and up to and referred to vehicle unregulated output.
4. Command Current 5 amps max.

3.4.5.2 Auxiliary Command Lines

3.4.5.2.1 Stored Program Lines

ACE shall provide test connector command capability for SP's 14, 17, 18, 20, 49 and 50. The command source shall be on the payload control panel in each launch complex. For electrical requirements reference paragraph 3.4.1.4 sec. b.

3.4.5.2.2 8-band Analog Commands

ACE shall provide test connector command and monitor capability for AM 6, 8, 9, 10, 11, 12, 14 and 15. For electrical requirements reference paragraph 3.4.1.2. These lines may be terminated on the Communications Control Panel.

3.4.5.2.3 VHF Commands

ACE shall provide test connector command capability for VHF channels 101, 102, 103, 104, 105, 107 and 113.

3.4.5.2.4 2-1 Plus A, B

The payload shall generate an emergency abort signal. The payload shall generate a signal to the vehicle to the effect of "abort". The payload shall provide fuel and oxidizer status signals to the vehicle. The payload shall provide fuel and oxidizer status signals to the vehicle.

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b. Electrical Description

1. Function duration - $31. \pm 1$ minute/per cycle.
2. Phase Shift (if a sine function) $0 \pm 5^\circ$ and $180 \pm 5^\circ$.
3. Function voltage - 12. millivolts max. based on 1.67 millivolts per quarter degree of phase.
4. Output impedance (loaded) 100 ohms max. at function voltage.
5. Output impedance (unloaded) 100 ohms max. at zero volts.

NOTE: Appropriate security measures shall be taken to prevent disclosure of payload program input to vehicle guidance system. For electrical requirements reference paragraph 3.4.1.1.

3.4.7 Umbilical Indicators

The vehicle shall provide umbilical monitor lines for the payload for use during pre-launch and countdown activities.

3.4.7.1 AF Mon. No. 1 and TLM OF Mon. (AJ-24X Pin 7)

AGE shall provide on each payload control panel two lamp indicators. One shall be wired to +4 VDC unregulated voltage and one shall be wired to unregulated return. There shall be a switch interrupt capability on this line at the payload control panel.

3.4.7.2 AF Mon. No. 2

AGE shall provide on each payload control panel a lamp indicator.



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Point termination designated AP Mon 6.

3.4.6.5 Relative Humidity Monitor (AJ 24K PH KE)

ACE shall provide on each payload control (AJ 24K PH KE) a Red Test point termination designated R.H. Mon.

3.4.7.6 Relative Humidity Monitor (AJ 24K PH FF)



Provided shall be a monitor payload data from all eight
lines available at 1 real time. Data shall be recorded on
a continuous strip provide permanent paper recordings.

The monitor lines shall be "1" applied on vehicle side of

AP-24K to PH 1, AP 1 Mon.

2, AP 2 Mon.

3, AP 10 Mon.

4, AP 6 Mon.

5, AP 13 Mon.

6, AP 8 Mon.

7, AP 18 Mon.

4.0 JUSTITY ATTENDANCE

Not Applicable

5.0 PERFORMANCE FOR DELIVERY

Not Applicable.

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